



Inoculation and P fertilizer improves food and feed production in grain legumes: Farmers' perceptions and treatment effects on yield and quality of residue biomass in Ethiopian highlands

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Outline



- Introduction
- Objectives
- Data collection and analysis
- Results
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Introduction



- Grain legumes are largely produced in smallholder crop-livestock production system, a predominant agricultural activity in Ethiopian highlands
- Both crop and livestock production are vital for the livelihood of smallholder farmers.
- The two sub-systems are complementary to each other and interdependent

Livestock contribute



- ✓ Draught power
- ✓ Cash availability
- ✓ Manure
- ✓ Transport services



Trends in feed supply



Human population increase



Expansion of cultivated land



Encroachment of cropping into pasture lands



Shrinkage of traditional grazing areas



Increased dependence on crop residues

Crop residues

- Make >50% of biomass of crops
- Have become increasingly important sources of animal feed
- Contribute about 50% of feed supply
- Low nutritive value and wide variability
- Grain legume residues have better quality than cereal straws and stovers
- Any improvement of crop residue yield and quality would contribute to improvement in livestock production



Objectives



- To evaluate effects of P fertilizer and *Rhizobium* inoculation on dry matter yield and nutritive value of grain legume haulms.
- To assess farmers' legume haulm utilization practices and their perception on the role of *Rhizobium* inoculation and P fertilizer in improving quantity and quality of haulm produced.

Data collection and analysis



Study sites: N2Africa project sites

Household survey

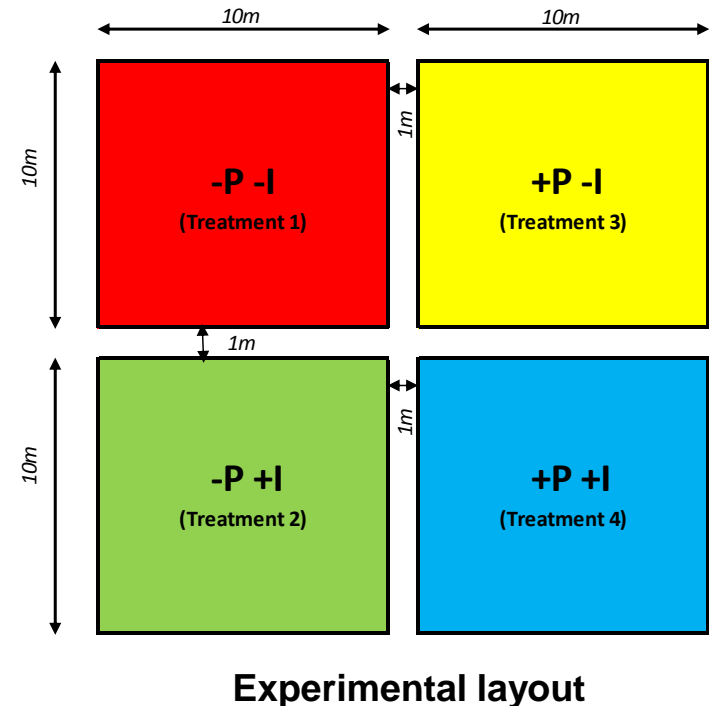
- 90 farmers engaged in N2Africa project in three districts (Ada'a, Sinana and Damot-Gale) were selected and interviewed using semi-structure questionnaire.
- The information collected included households' legume haulm use practices and their perception on the effects of the inputs on haulm biomass yield and quality.

Data collection and analysis

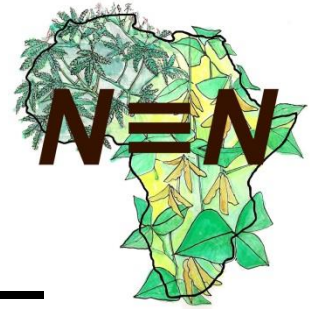


Experimental study

- Four grain legumes (Faba bean, chickpea, haricot bean and soybean) were established under four fertilizer treatments (Figure 1) on selected farmers' plots.
- Yield data (grain and haulm) was collected.
- Grain and haulm samples were collected and analyzed.

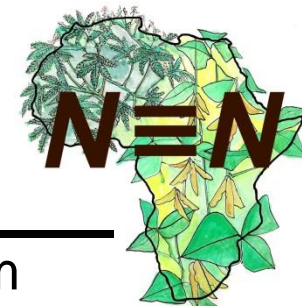


Results: Use of haulms in the study area



Variables	Measures	HH responses (%)
Uses of haulms	Feed source	76.7
	Bio-fuel	11.4
	Mulching/bio-fertilizer	8.8
	Income source	3.1
Trends of haulm use as feed	Increasing	90.0
	No change	5.6
	Don't know	4.4

Results: Household perception on impacts of inoculation and P application on haulm traits

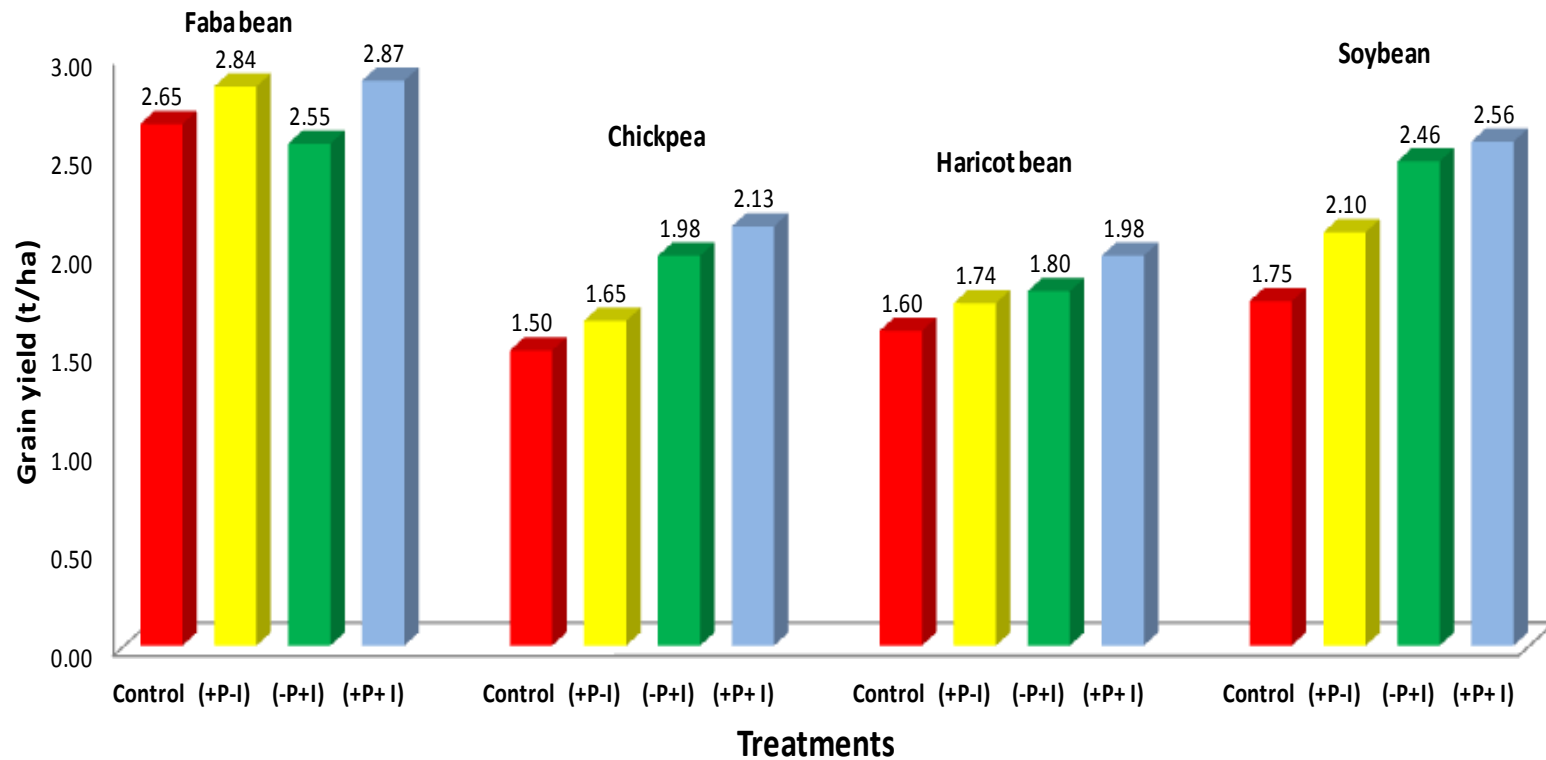


Variables	Measures	Haulm Yield (%)	Haulm quality (%)
Do you think inoculants and P fertilizer application affect...?	Yes	62.2	32.2
	No	13.3	21.1
	Don't know	24.5	46.7
	Total	100	100
What impact is expected?	Improved	100	62.1
	Decreased	-	37.9
	Total	100	100

Result



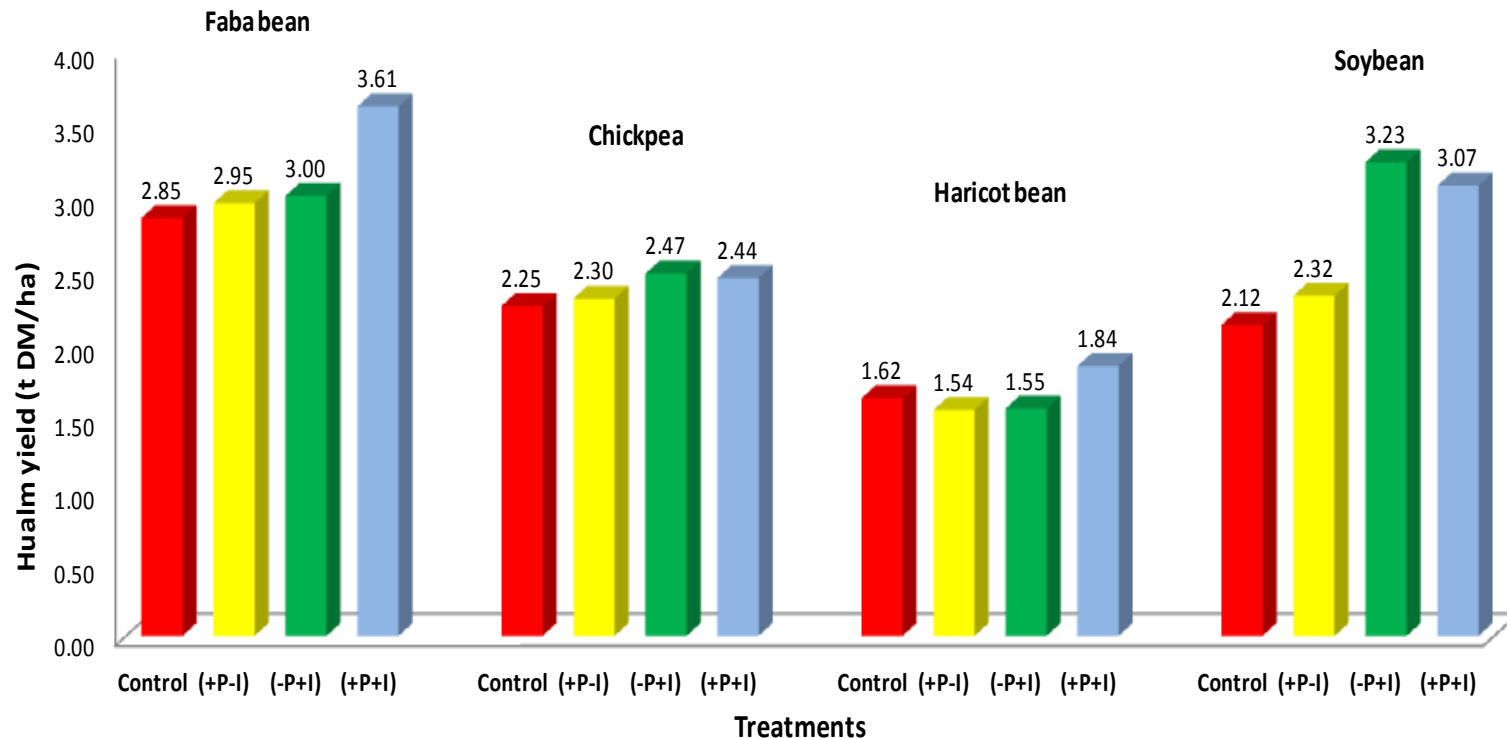
Grain yield responses of the legumes to rhizobium inoculation and/or P fertilizer



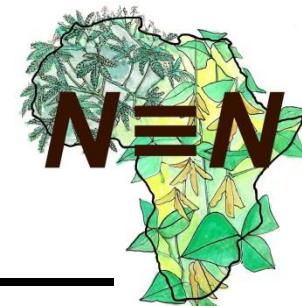
Result



Haulm yield responses of faba bean, chickpea, haricot bean and soybean to rhizobium inoculation and/or P fertilizer



Results: Nutritional quality of faba bean haulm



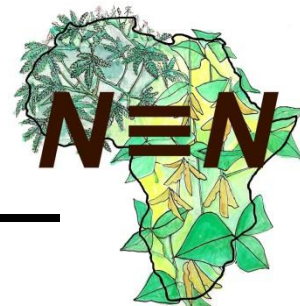
Parameters	Treatment			
	+P+I	-P+I	+P-I	-P-I
CP (%DM)	6.52 ^a	6.45 ^a	6.38 ^a	5.25 ^b
NDF (%DM)	64.9 ^b	64.9 ^b	64.8 ^b	70.5 ^a
IVOMD (%DM)	47.0 ^a	46.4 ^a	46.7 ^a	43.0 ^b
ME (MJ/Kg DM)	6.85 ^a	6.77 ^a	6.81 ^a	6.29 ^b

Results: Nutritional value of chickpea haulm



Parameters	Treatment			
	+P+l	-P+l	+P-l	-P-l
CP (%DM)	4.32 ^a	3.66 ^b	3.60 ^b	3.31 ^c
NDF (%DM)	62.1	63.0	63.5	63.2
IVOMD (%DM)	47.7 ^a	46.5 ^{ab}	45.8 ^b	45.9 ^b
ME (MJ/Kg DM)	7.36 ^a	7.14 ^b	7.07 ^b	7.06 ^b

Results: Nutritional values of haricot bean haulm



Parameters	Treatments			
	+P+I	-P+I	+P-I	-P-I
CP (%DM)	7.50 ^a	6.85 ^{ab}	6.72 ^b	5.94 ^c
NDF (%DM)	67.8 ^b	69.0 ^{ab}	69.9 ^a	69.8 ^a
IVOMD (%DM)	57.8 ^a	56.8 ^{ab}	55.8 ^b	55.7 ^b
ME (MJ/Kg)	8.72 ^a	8.65 ^{ab}	8.58 ^b	8.58 ^b

Results: Nutritional value of soybean haulm



Parameters	Treatments			
	+P+l	-P+l	+P-l	-P-l
CP (%DM)	6.74 ^a	6.08 ^a	5.30 ^b	4.67 ^b
NDF (%DM)	74.1 ^b	75.3 ^{ab}	75.5 ^a	76.4 ^a
IVOMD (% DM)	50.6 ^a	50.2 ^{ab}	49.4 ^b	49.6 ^b
ME (MJ/Kg DM)	8.82	8.79	8.76	8.74

Results: Grain quality of chickpea, haricot bean and soybean



Crop spp.	Parameters	+P+I	-P+I	+P-I	-P-I	SL
Chickpea	CP (%DM)	20.2	19.7	19.8	19.8	ns
	ME (MJ/Kg DM)	10.49	10.46	10.5	10.49	ns
	IVOMD (% DM)	72.1	71.8	72.0	72.0	ns
Haricot bean	CP (%DM)	27.5 ^{ab}	26.8 ^b	27.8 ^a	27.0 ^b	*
	ME (MJ/Kg DM)	11.92 ^b	11.87 ^b	11.98 ^a	11.89 ^b	**
	TIVOMD (% DM)	82.6 ^{ab}	82.3 ^b	83.2 ^a	82.4 ^b	**
Soybean	CP (%DM)	42.97 ^a	43.17 ^a	40.73 ^b	39.32 ^b	***
	ME (MJ/Kg DM)	10.14 ^a	10.15 ^a	9.73 ^b	9.50 ^b	***
	TIVOMD (% DM)	78.12 ^a	78.32 ^a	75.13 ^b	73.40 ^b	***

Conclusion



- The study showed that grain legume haulm is dominantly used as livestock feed with increasing trend
- Inoculation and P fertilization significantly improved grain yield in all crops and haulm yield of all crops except chickpea
- The soil fertility treatments improved the protein and energy contents while reducing the fiber content of the haulm => improved digestibility (IVOMD)
- ✓ **Can enhance whole plant value and use of grain legumes in smallholder mixed crop-livestock production system.**

Acknowledgements



- N2Africa project - ILRI
- Partners at each project site
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